

3/prt/

1 Mobile computing system architecture

2

3 The present invention relates to the field of mobile  
4 computing solutions. A particular embodiment relates to  
5 a fully customisable system and software means for co-  
6 ordinating, organising and fulfilling the computing needs  
7 of mobile workers.

8

9 At the present time, many industries provide mobile  
10 workers with mobile computing and communication devices  
11 which are used to provide the mobile worker with  
12 information they need to carry out their job, and also to  
13 store information reporting the tasks they have carried  
14 out. Example mobile workers are meter readers, goods  
15 delivery workers, travelling salesmen etc. Examples of  
16 the type of information would be a list of things to do  
17 during the day, customer addresses etc and then  
18 confirmation and verification information that tasks had  
19 been carried out, time stamps for particular events, new  
20 client information, notes etc.

21

1 For example, a postal delivery worker might, on a daily  
2 basis, download a list of parcels to deliver, where and  
3 when they have to be delivered and may, in the course of  
4 deliveries, scan parcel bar codes or make records to show  
5 that deliveries have been completed at particular times.  
6 Typically, these systems require considerable hardware  
7 specific programming and implementation. Such systems  
8 need customised depending on the nature of the hardware  
9 devices carried by mobile workers, the servers organising  
10 the system and the networking hardware (e.g. ethernet,  
11 telephone network) use for interfacing with mobile units  
12 at the beginning and end of the day. As well as the time  
13 and expense involved in customisation this means that  
14 individual organisations have separate and non-compatible  
15 mobile computing solutions.

16  
17 Recently, internet-based application servers have become  
18 a popular method of delivering computing solutions to  
19 multiple users. It would be desirable to provide an  
20 application server adapted for the needs of companies  
21 with mobile workers. However, given the use by different  
22 firms of different hardware and software programs it is  
23 hard to see how this could be achieved and so an aim of  
24 the present invention is to provide application server  
25 technology for use in delivering mobile computing  
26 solutions to multiple users, being fully internet  
27 enabled, customisable and requiring minimal or no  
28 configuration by mobile workers.

29  
30 One aim of the present invention is to provide a system  
31 which can be operated using any type of commercially  
32 available mobile computing hardware without  
33 customisation. In the present system the only action  
34 typically required by a user to configure a mobile unit

1 for use with the system is to input one internet address  
2 once.

3

4 A further aim of the present invention is to provide a  
5 means for enabling the system to function when individual  
6 mobile communication and computing devices are  
7 periodically on and off-line. In one extreme at the  
8 present time, mobile computing device have information  
9 downloaded into them once per day (e.g. a list of tasks)  
10 and uploaded to a central server at the end of the day.

11 In another extreme it is known to provide a web server  
12 application which can be accessed online; however, this  
13 type of system cannot function when offline and, as it is  
14 prohibitively expensive to remain permanently connected,  
15 is not financially viable.

16

17 Therefore, another aim of the present invention is to  
18 enable mobile workers to benefit from the communications  
19 possibilities of mobile network communications with a  
20 base system, whilst continuing to be able to function  
21 seamlessly when said mobile communications networks are  
22 unavailable.

23

24 A further aim is to gain the benefits of dynamic  
25 communication with a remote server without the high costs  
26 of, for example, an always on internet connection.

27

28 A further aim of the present invention is to provide a  
29 worker with access to the task and data information  
30 servers belonging to a plurality of third party  
31 organisations which have different hardware and software  
32 systems.

33

1 A yet further aim is to implement the above aims whilst  
2 requiring the mobile units to have only standard browser  
3 and communications software and hardware.

4

5 According to a first aspect of the present invention  
6 there is provided a system comprising:

7

8 a plurality of mobile units for use by mobile users;

9

10 an application server;

11

12 communications means for enabling said mobile units  
13 to communicate with the application server;

14

15 a subscriber database comprising information about  
16 the software and/or hardware capabilities of  
17 individual mobile units;

18

19 a script database comprising equivalent script  
20 segments for carrying out particular functions on  
21 mobile units with different software and/or hardware  
22 capabilities; wherein

23

24 the application server is adapted to provide an  
25 application script to a mobile unit, said  
26 application script being prepared from script  
27 segments selected from the script database according  
28 to the information about the mobile unit stored in  
29 the subscriber database.

30

31 Preferably, the system further comprises a master  
32 database, said master database having mobile user  
33 specific data, said application script further comprising

1 mobile user specific data specific to the mobile user  
2 acquired from the master database.

3

4 Preferably, a mobile unit stores a copy of said mobile  
5 user specific data.

6

7 More preferably, a mobile unit edits the copy of said  
8 mobile user specific data.

9

10 Preferably also, the copy of said mobile user specific  
11 data is synchronised with the mobile user specific data  
12 stored in the master database.

13

14 Most preferably, the application script is synchronised  
15 concomitantly with synchronisation of the mobile user  
16 specific data.

17

18 Typically, the mobile user specific data relates to tasks  
19 carried out by said mobile user.

20

21 Preferably mobile user specific data relates to tasks  
22 which have been or are being carried out by said mobile  
23 user.

24

25 Preferably, the system further comprises master  
26 application program code means which are interpreted by  
27 the application server to prepare the application script.

28

29 Most preferably, the master application program code  
30 means is stored in markup language.

31

32 Said mobile units may communicate with the application  
33 server over the internet.

34

1 Said mobile units may comprise a browser, said browser  
2 executing the application script.

3

4 According to a second aspect of the present invention  
5 there is provided a method comprising the steps of:

6

7 acquiring information about the software and/or hardware  
8 capabilities of a mobile unit from a subscriber database,  
9 the mobile unit being for use by a mobile user; and

10

11 preparing an application script customised for the mobile  
12 unit from script segments being selected from a script  
13 segment database according to the software and/or  
14 hardware capabilities of the mobile unit.

15

16 Preferably, said application script further comprises  
17 data specific to a mobile user acquired from a master  
18 database of mobile user specific data.

19

20 Preferably also, a mobile unit stores a copy of said data  
21 specific to a mobile user.

22

23 Preferably, the copy of the data specific to a mobile  
24 user is edited by the mobile user.

25

26 More preferably, the method further comprises the step of  
27 synchronising the copy of the data specific to a mobile  
28 user with the data specific to a mobile user stored in  
29 the master database.

30

31 Preferably, said data specific to a mobile user comprises  
32 information concerning tasks to be performed by or which  
33 have been performed by said mobile user.

34

1 Preferably, said application script is prepared with  
2 reference to a master application.

3

4 Typically, said master application is stored in the form  
5 of a markup language.

6

7 A mobile unit may comprise a browser and the application  
8 script be executed by said browser.

9

10 According to a third aspect of the present invention  
11 there is provided a computer program comprising program  
12 instructions which, when loaded into a computer, comprise  
13 the application server of the system of the first aspect.

14

15 According to a fourth aspect of the present invention  
16 there is provided a computer program comprising program  
17 instructions for causing a computer to perform the  
18 process of any of the second aspect.

19

20 According to a fifth aspect of the present invention  
21 there is provided a computer program comprising the  
22 application script of any of the second aspect.

23

24 The present invention will now be illustrated with  
25 reference to the following figures in which:

26

27 Figure 1 shows a schematic diagram of overall system  
28 architecture;

29

30 Figure 2 shows a flow chart of a typical days  
31 operations by a mobile worker;

32

Figure 3 shows a block diagram of components of a mobile device according to the present invention.

#### System overview

Figure 1 illustrates in block format the individual components of the system and the connectivity between them. The system comprises a web application server 100, and a plurality of mobile computing devices capable of executing scripts shown by way of example as 201 - 204 and referred to generally as 200. Typically, there are further provided one or more information servers shown by way of example as 451 - 453 and referred to generally as 450.

The invention comprises program code, usually localised on the web application server, to enable different mobile units to function with the web application server. The invention also comprises one or more applications in a mark-up language, referred to below as mobile application mark-up language (MAML), and the overall methodology and hardware of the system as a whole. MAML Applications dictate mobile device functionality and, in two different embodiments are either (a) interpreted into a script language appropriate to an individual mobile unit with reference to a database 150 of subscriber mobile unit information or (b) transmitted in MAML to the mobile computing devices which have thereon MAML interpreters.

1 The invention also comprises a further protocol using  
2 markup language, here termed Application Extensible  
3 Mobile Language (AXML) used for exchange of information  
4 between the web application server and information  
5 servers.

6  
7 The mobile devices **200** for use with the system can be of  
8 a variety of different types. The requirements of each  
9 are that it can communicate with the web application  
10 server, downloading and executing scripts and having the  
11 capacity to upload data.

12  
13 Mobile device hardware/software

14  
15 Example mobile devices **200** would be a Windows CE™ mobile  
16 device **201** with JavaScript™ enabled browser **211**, a WAP  
17 mobile device **202** with WMLScript™ **212** connected through a  
18 WAP server **222**, a KVM™ mobile device **203** or Java™ virtual  
19 machine. Future technologies such as iMode™ and other  
20 formats could clearly also be used. In another  
21 embodiment an uninterpreted Application in the  
22 proprietary format herein referred to as MAML, discussed  
23 below can be interpreted by a MAML enabled mobile device  
24 **204**. Essentially, each mobile device **200** requires the  
25 capacity to exchange information with the web application  
26 server **100**, execute a script and input/output data  
27 through a user interface.

28  
29 Browsers may be supplemented by ActiveX™ components or  
30 Java™ Applets on the device to communicate with device  
31 specific interfaces **220** for driving peripherals **221**, for  
32 example, software and hardware interfaces for signature  
33 capture systems, scanners, printers, the global  
34 positioning system, mobile telephone locating systems

1 etc. This means that the mobile device can be used more  
2 or less out of the box with no specific applications or  
3 data required.

4  
5 Mobile devices may for example be in the form of mobile  
6 telephones, palmtop organisers, laptop computers,  
7 computers integrated into vehicles etc. Users of mobile  
8 devices will typically be travelling workers such as  
9 salesmen, meter readers, delivery workers, van drivers,  
10 factory workers or robots.

11  
12 In the example embodiment, mobile devices **200** communicate  
13 with the central web application server **100** via a network  
14 server **125**, typically an HTTP server, using TCP/IP.  
15 Communication between server **125** and mobile units **200** is  
16 through a communications network **300**. The communications  
17 network **300** could be a fixed PSTN line, LAN or WAN into  
18 which mobile units **200** can be connected from time to  
19 time, but will preferably be a mobile communications  
20 network such as GSM, GPRS or future mobile telephone  
21 systems. The mobile device could also be connected to  
22 either an Intranet or an Internet via a standard RAS  
23 connection using a direct network connection.  
24 Information is exchanged between the network server **125**  
25 and mobile units **200** using known hardware independent  
26 exchange protocols such as TCP/IP. Use of a standard  
27 protocol such as TCP/IP allows different physical  
28 communications **300** to be readily used with different  
29 mobile devices **200**. Different types of physical  
30 communications network can be integrated as alternatives  
31 or consecutively as a data transmission pathway.

32  
33 Application server hardware/software

34

1 The web application server can be implemented in an  
2 industry standard development environment and application  
3 server for example COLDFUSION™. Usefully COLDFUSION™ can  
4 be run on any platform such as Windows NT™, SOLARIS™,  
5 LINUX™. The HTTP servers can be implemented using, for  
6 example, APACHE™, or other similar servers.

7  
8 The web application server **100** has access to a subscriber  
9 database **150** which comprises information about the  
10 hardware and software capabilities, configuration and  
11 user data relating to individual subscriber mobile  
12 devices showing generally as **200**. The subscriber  
13 database is describe further below. Typically, the  
14 subscriber database is directly connected to the web  
15 application server **100**; alternatively, information can be  
16 stored on information servers or MAML enabled mobile  
17 devices **204**.

18

19 Information server hardware/software

20

21 Information server systems comprise typically, an HTTP  
22 server **400**, an information server. Native or ODBC  
23 drivers **470** may be used to interface between an server  
24 **451** and associated database **460**. Said databases and  
25 drivers are readily implemented using common software  
26 tools available from, for example, Sybase™, Oracle™,  
27 DB2™, SQL server™ etc. Commonly available information  
28 servers include those sold by VANMAN™, OPTRAC™ and  
29 Systems Union™.

30

31 Typically, the central web application server **100** is  
32 connected through the internet to one or more information  
33 server systems shown by way of example as **451**, **452** and  
34 **453** and referred to generally as **450**. The information

1 servers **450** may belong to the same organisation that owns  
2 the web application server **100** or may belong to third  
3 party organisations. Importantly, each of these  
4 information server systems may be entirely different in  
5 internal composition and configuration. The only  
6 requirement is that they can communicate with the central  
7 web application server in a specified interface format  
8 discussed below. The information servers function to  
9 provide information required by users of mobile units and  
10 to store information returned by them. For example, an  
11 information server may comprise information about a list  
12 of tasks to be performed on a particular day by a  
13 particular mobile user, belonging to a particular  
14 organisation which has subscribed to the facility  
15 provided by the web application server **100**.

16

#### 17 Use of system by end user

18

19 Figure 2 shows a flow chart of an example day's use of a  
20 mobile communications device and of the systems owned by  
21 an individual travelling worker. An important is that  
22 the system as a whole can work with different mobile  
23 units without them requiring extensive personalisation.  
24 The aspect of the system which makes this possible is the  
25 ability of the web application server to store in the  
26 subscriber information database information about the  
27 individual mobile unit and the use of MAML/AXML described  
28 below to customise the script sent to the individual  
29 mobile unit.

30

31 To begin with **601**, the mobile communications device  
32 connects across a network such as an Intranet or the  
33 Internet as discussed above to the central web  
34 application server **100**. After connecting **602**, the device

1 logs in **603** to an information server **450** or central web  
2 application server **100**, for example, using TCP/IP. The  
3 mobile unit might log into a start page defined by a  
4 universal resource locator, for example it might connect  
5 to a web page belonging to a proprietor/user of an  
6 information server **450**, preferably this will be the  
7 internet address of the web application server **100**.

8

9 The mobile unit may be pre-set up for a particular user  
10 with password etc information. Alternatively, the web  
11 application server may use caller line identification,  
12 cookies or other identification techniques to establish  
13 the user. The user is then either recognised or rejected  
14 **604**. Upon log-in the system identifies the user **605** and  
15 their device as this is part of the user set-up. The  
16 subscriber database **150** may contain further information  
17 relating to the particular user of the mobile device,  
18 such as the type of device they are using, their  
19 location, the nature of their business, the type of third  
20 party application servers **450** to which they should be  
21 allowed access etc. A document is then downloaded **606**  
22 from the central web application server and third party  
23 application servers **415**. The particular information  
24 downloaded is based on information held in the central  
25 subscriber database **150** and task information stored in  
26 third parties databases and servers **450 460**.

27

28 These can be managed directly from the depot which  
29 controls individual projects. For example, it will  
30 prescribe a particular series of tasks such as locations  
31 we visited, parcels to be dropped off which has been  
32 decided by the depot. The information is downloaded in  
33 the form of a script comprising both an application and  
34 associated data. The script is customised for the

1 particular mobile unit and mobile worker, the application  
2 being adapted to function on their particular mobile unit  
3 and the data being customised to a particular list of  
4 tasks. This customisation is described further below.

5

6 At some point after recognition 605 and typically after  
7 download or concurrently with download 606, the mobile  
8 unit 200 will in some embodiments be locked 607 to  
9 prevent access to other functionality. This enables the  
10 complete functionality of the hand-held unit to be  
11 prescribed, although, for example, a restricted option  
12 password may be provided to allow a return to full  
13 operating system functionality. The access to other  
14 mobile device functionality whilst the programme is  
15 running may be varied depending on information held on  
16 the subscriber database 150 about the nature of the user  
17 and their level of technical sophistication. Locking is  
18 not essential but will be preferred for some users.

19

20 Next, the user will perform their day's work 608. For  
21 example, they will be able to print information such as  
22 receipts, print-outs of job tasks etc., look at lists of  
23 tasks and associated information. They will be able to  
24 read bar code information, read/write to intelligent tags  
25 etc. They may be able to capture signatures and other  
26 identifying material and transmit these back to base. A  
27 benefit of the invention is that instead of them having  
28 to perform this upload only at the end of the day or only  
29 on-line every time they carry out a transaction, data and  
30 application synchronisation can be performed at  
31 intervals. Furthermore, they will be able to read credit  
32 cards/smart card information, handle complex transaction  
33 information such as calculating pricing costs etc off-  
34 line and will be able to communicate with other devices

1 such as vehicle black boxes, GPS etc 218. Importantly,  
2 interface design will be simple and easy to use.

3

4 At any point during the day the user will be able to  
5 synchronise 609 / transmit / download information from  
6 the Web application server 100 and information servers.  
7 For example, they would be able to transmit information  
8 of work that has been completed such as parcels picked up  
9 or delivered, and pick up information about new work. As  
10 well as just exchanging and synchronising data, the  
11 system is also capable of exchanging and synchronising  
12 the actual application software running on the mobile  
13 unit. Therefore they can readily download updates to  
14 software. This feature might be particularly important  
15 when they wish to deal with several different third party  
16 information services 451, 452 and 453 for which different  
17 software will be required.

18

19 The term "synchronise" refers to the known process of  
20 making two different data sets, such as lists of tasks,  
21 correspond in meaning. Typically, the list of tasks in  
22 the mobile unit is synchronised with the list of tasks  
23 stored in an information server 450 or associated  
24 database 460. For example, when the mobile unit has  
25 updated a record relating to a particular task, the  
26 synchronisation process would involve updating the record  
27 in the database 460 with that updated record. Rules can  
28 readily be written by one skilled in the art to deal with  
29 situations when both records may have changed.

30 Application synchronisation involves ensuring that the  
31 application within the mobile unit is the version  
32 considered most appropriate by the web application server  
33 100.

34

1 At the end of the day the user can then reconnect to the  
2 central web application server 100 and upload data 610  
3 concerning their tasks carried out during the day. At  
4 that point the day's tasks end 611 and information to do  
5 with one journey is finished and another journey can be  
6 begun immediately or at a later date. Although one day  
7 has been referred to as the duration of an individual  
8 journey in this application, it will be clear to one  
9 skilled in the art that this could be any period, for  
10 example, a few hours or a few days or weeks or even  
11 indefinitely.

12  
13 The above operation routine is common to all potential  
14 use of the system, for example van sales, parcel  
15 delivery, fuel service etc.

16  
17 Data formats

18  
19 A variety of different information exchange formats are  
20 used between different components of the system and  
21 several of these are new and important to the  
22 functionality of the invention. Importantly, application  
23 and data information delivered to individual mobile units  
24 is in the form of script in standard mark-up language.  
25 Whereas the information delivered and the way in which it  
26 operates is new, the underlying software, being delivery  
27 of web documents through standard HTTP servers, is  
28 standard allowing integration with common known software  
29 and hardware implementations. HTTP is used as common  
30 protocol for communications and also allows the central  
31 web application server 100 to exchange information with  
32 other HTTP servers 400, database sources and other  
33 devices such as mobile telephones etc.

34

1 As discussed above, each mobile device **200** has the  
2 capacity to execute a script and input/output data with a  
3 user.

4  
5 The central web application server **100** accepts,  
6 validates, authenticates and processes requests from the  
7 mobile units **200**. Importantly, the central web  
8 application servers provides a subscriber database **150** to  
9 use in this process. This database contains information  
10 on the types of browsers, other software components,  
11 subscribers applications and any spoken language  
12 translations provided on individual mobile units. The  
13 information for the subscriber database can be imported  
14 from the information servers **450** or the information  
15 servers associated databases **460**, or may be maintained  
16 standalone and connected directly to the web application  
17 server as shown in Figure 1. Alternatively, the  
18 subscriber database can be held in a plurality of  
19 locations.

20  
21 Once requests for information are received from the  
22 mobile unit and validated, script is then delivered by  
23 the central web application server **100** to the mobile unit  
24 **200**. Importantly, the central web application server **100**  
25 obtains data and application information relevant to the  
26 user of the individual handheld unit **200**, for example  
27 task lists, from the relevant HTTP information server **400**  
28 in the form of a specialised version of XML, referred to  
29 herein as application extensible mark-up language, AXML.

30  
31 This data is then combined with application related  
32 information which is assembled in the form of mobile  
33 application mark-up language, MAML which is a format we  
34 have designed to enable the HTML/JavaScript capabilities

1 and mobile browsers (or in the case of WAP browsers,  
2 WML/WMLScript) to function with this system. MAML also  
3 allows the delivered application to continue running and  
4 being used without the browser being connected to the  
5 server. It also provides specific functions required on  
6 the individual mobile device **200** to make that application  
7 easy and fast to use.

8

9 Data flow, MAML interpretation

10

11 Figure 3 shows an example of the flow of data through the  
12 system. In this example, a mobile unit **200** sends an HTTP  
13 request to the web application server **100**. In response  
14 to this the web application server **100** makes a further  
15 HTTP request to an information server **450** in AXML for  
16 task data relating to the particular user of the mobile  
17 unit.

18

19 Task related data **701** is stored within a database **750** and  
20 in an example format contains header information **704**  
21 relating to a particular individual **703** and a particular  
22 day **702**. The database **750** can be stored on or associated  
23 with an information server or in any other location  
24 directly or indirectly accessible by the web application  
25 server **100**. A list of tasks **705**, **706** etc is also stored  
26 in an appropriate data format as will be clear to one  
27 skilled in the art. Example tasks might involve a  
28 particular action (deliver a parcel / meet a client /  
29 read a meter), identifier information (location for a  
30 delivery, identifier for a parcel, miscellaneous  
31 information data), time and location information.

32

33 Task data can be submitted to the system in numerous  
34 ways. For example, it could be held on task information

1 databases associated with third party information servers  
2 **450** to enable easy interface with in-house systems.  
3 Alternatively, it could be submitted over the internet  
4 directly to a task information database associated with  
5 the web application server **100**. For example, a worker at  
6 a factory requiring delivery of a product might use  
7 conventional web technology to submit a request to a web  
8 site associated with the tasks information databases for  
9 said particular product to be delivered. Information  
10 might also be supplied by mobile users, during the  
11 process of application and data synchronisation or as  
12 separate requests.

13  
14 In response to the request from the web application  
15 server **200**, the task data record **701** is then processed by  
16 the information server **450** and transmitted to the central  
17 web application server **100** in the form of an AXML  
18 document **710**.

19  
20 An Application **715** for interpretation and delivery to the  
21 mobile unit **200** is stored in MAML format, typically on  
22 the web server **100** although it can be supplied by  
23 information servers **450** or other sources. In order to  
24 prepare a script **740** to transmit to the mobile unit, the  
25 AXML document **710** and MAML Application **715** are required,  
26 along with two different further classes of data records:  
27 a subscriber database **720** and script database **730** are  
28 usually held within the subscriber database **150**. The  
29 subscriber database **720** contains information concerning  
30 the particular user of a mobile unit **200** and the  
31 configuration and capabilities of that unit and  
32 peripherals associated therewith. The script database  
33 **730** contains hardware and software specific segments of

1 script. Preferably, subscriber database and script  
2 database are both in the form of lists.

3

4 MAML is interpreted by the web application server 100 by  
5 sequentially selecting script segments from script  
6 database 730 as appropriate depending on the user  
7 information stored in the subscriber database 720. For  
8 example, the script segment data records will contain  
9 script for common functions e.g. displaying buttons,  
10 formatting frames, displaying text etc. in several  
11 different formats such as WML Script, JavaScript etc. and  
12 the appropriate script segment is selected depending on  
13 the type and capabilities of the machine as stored in the  
14 user information records 120.

15

16 Therefore a script 740 comprising an interpreted  
17 application is produced and combined with the data  
18 received in AXML format. This is then delivered to the  
19 mobile unit 200 where it is executed. As part of the  
20 execution process, the copy of the data on the mobile  
21 unit 200 can be viewed, amended, edited, deleted or added  
22 to. Importantly, this can be carried out whilst the  
23 mobile unit 200 is offline.

24

25 Whilst it runs offline the data contained within the  
26 script can be altered and records containing additional  
27 information, such as signatures, notes and timestamps  
28 relating to deliveries and events can be stored within  
29 for transmission back to the mobile web application  
30 server 100 the next time the mobile unit communicates  
31 with the web application server 100.

32

33 Periodically the mobile unit 200 can request  
34 synchronisation and the task data is synchronised with

1 that stored in the task database **460**, being reconverted  
2 into AXML for transmission to information servers **450**.

3

4 As a result of this process, information for transmission  
5 to/from diverse information servers **450**, can be  
6 integrated into a standardised form and exchanged with  
7 diverse mobile units **200**. This allows the owners of the  
8 information servers **450** to concentrate on provision of  
9 the data being exchanged whereas the owners of the  
10 central web application server **100** can concentrate on the  
11 front end, user interface and, importantly, adaptation  
12 for different software and hardware configurations of  
13 mobile unit.

14

15 XML data may be converted into different markup formats  
16 using the XML document transformation standard XSLT  
17 (Extensible Stylesheet Language Transformations) or  
18 similar transformation techniques. This may be required  
19 to enable particular information servers **450** to  
20 communicate with HTTP servers **400**.

21

22 The present invention has enabled mobile workers to use  
23 mobile units with regularly updated applications and  
24 information without requiring the costs of an always-on  
25 connection or the time limitations of only being able to  
26 download/upload information on a daily basis.

27

28 Furthermore, the invention enables owners of information  
29 servers to maintain their databases without requiring  
30 them to additionally take on the complex role of  
31 providing access to their databases to mobile users who  
32 may have a plurality of different types of device.

33

1 This also enables a mobile user 100 to carry out tasks  
2 relating to multiple corporations as a single web  
3 application server 100 can interface with several  
4 information servers 450.

5

6 As the invention relates to the overall configuration of  
7 the system and the functionality of the central web  
8 application server 100, information server 450 and  
9 associated databases 150, 460, standard mobile computing  
10 devices can be immediately used with the system with  
11 minimal or no customisation, providing a cost-effective  
12 solution.

13

14 In another embodiment, the web application server 100  
15 functionality is fully integrated with an information  
16 server 450 and the relevant software may be provided as a  
17 module to add functionality to an information server 450.

18

19 In further embodiments the information provided to mobile  
20 users need not be limited to task related information.

21 The system will be useful wherever data can usefully be  
22 distributed to and received from mobile users using  
23 diverse mobile units 200. It is particularly beneficial  
24 when the ability to keep working on the data when it is  
25 offline is useful. For example, it could be applied to  
26 the field of computer games. In this embodiment, the web  
27 application server 100 or information servers 450  
28 maintain a central database relating to a multiplayer  
29 game: e.g. attributes of players, characters, simulated  
30 universes etc. in a manner associated with games such as  
31 Civilisation<sup>TM</sup>, Age of Empires<sup>TM</sup>, multi user dungeons,  
32 Pokemon<sup>TM</sup> etc. The web application server 100 with  
33 reference to the subscriber database 150 enables  
34 information relating to the game plus an associated

1 application in the form of a script customised to the  
2 particular mobile unit 200 to be delivered to individual  
3 players. The downloaded script then allows the player to  
4 continue play off-line, using, amending and adding to the  
5 stored information which is then synchronised  
6 periodically with the central database.

7

8 Further modifications and improvements can be made by one  
9 skilled within the art within the scope of the invention  
10 herein disclosed.

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